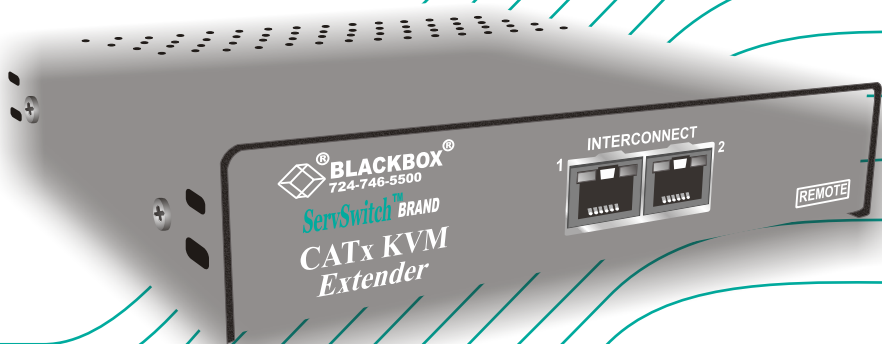


ServSwitch™ BRAND
CATx KVM Extender



ACU6001A
ACU6022A
ACU6201A
ACU6222A

Welcome to the ServSwitch™ Family!

Thank you for purchasing a BLACK BOX® ServSwitch™ Brand CATx KVM Extender model! We appreciate your business, and we think you'll appreciate the many ways that your enhanced keyboard/video/mouse system will save you money, time, and effort.

That's because our ServSwitch family is all about breaking away from the traditional, expensive model of computer management. You know, the one-size-fits-all-even-if-it-doesn't model that says, "One computer gets one user station, no more, no less." Why not a single user station (monitor, keyboard, and mouse) for multiple computers—even computers of different platforms? Why not a pair of user stations, each of which can control multiple computers? Why not multiple user stations for the same computer?

With our ServSwitch products, there's no reason why not. We carry a broad line of robust solutions for all these applications. Do you have just two PCs, and need an economical alternative to keeping two monitors, keyboards, and mice on your desk? Or do you need to share dozens of computers, including a mix of IBM® PC, RS/6000®, Apple® Macintosh®, Sun Microsystems®, and SGI™ compatibles among multiple users with different access levels? Does your switch have to sit solidly on a worktable and use regular everyday cables? Or does it have to be mounted in an equipment rack and use convenient many-to-one cables? No matter how large or small your setup is, no matter how simple or how complex, we're confident we have a ServSwitch system that's just right for you.

The ServSwitch™ family from Black Box—the one-stop answer for all your KVM-switching needs!

This manual will tell you all about your new ServSwitch™ Brand CATx KVM Extender, including how to install, operate, and troubleshoot it. For an introduction to the Extender, see **Chapter 2**. The Extender product codes covered in this manual are:

ACU6001A

ACU6022A

ACU6201A

ACU6222A

User Guide Revision: 2.0 (November 2009)

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While every precaution has been taken in the preparation of this manual, the manufacturer assumes no responsibility for errors or omissions. Neither does the manufacturer assume any liability for damages resulting from the use of the information contained herein. The manufacturer reserves the right to change the specifications, functions, or circuitry of the product without notice.

The manufacturer cannot accept liability for damage due to misuse of the product or due to any other circumstances outside the manufacturer's control (whether environmental or installation related). The manufacturer shall not be responsible for any loss, damage, or injury arising directly, indirectly, or consequently from the use of this product.

Cautions and Notes

The following symbols are used in this guide:



CAUTION. This indicates an important operating instruction that should be followed to avoid any potential damage to hardware or property, loss of data, or personal injury.



NOTE. This indicates important information to help you make the best use of this product.

**FEDERAL COMMUNICATIONS COMMISSION
AND CANADIAN DEPARTMENT OF COMMUNICATIONS****RADIO-FREQUENCY INTERFERENCE STATEMENTS**

This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Shielded cables should be used with this equipment to maintain compliance with radio frequency energy emission regulations and ensure a suitably high level of immunity to electromagnetic disturbances.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par le Ministère des Communications du Canada.

EUROPEAN UNION COMPLIANCE STATEMENT

WARNING!

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user might be required to take adequate remedial measures.

This product complies with the following harmonized standards for Information Technology Equipment: EN55022:2006 (Class A), EN55024:1998 + A1:2001 + A2:2003.

To maintain compliance the use of correctly installed shielded (STP/FTP) interconnection cable is advised. Only use CPU cables and power supplies provided (or recommended) for use with this product.

When used in environments that have high levels of electromagnetic interference or excessive power ground noise, you may experience disturbances to video and/or data transmission. If this is the case, please refer to the Troubleshooting section of the User Guide for further information, or contact Technical Support. In electrically noisy environments, the use of shielded (STP/FTP) rather than unshielded (UTP) interconnection cable is recommended.



NORMAS OFICIALES MEXICANAS (NOM)

ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestals que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

Safety Precautions and Installation Guidelines

To ensure reliable and safe long-term operation please note the following installation guidelines:

- Do not use to link between buildings.
- Only use in dry, indoor environments.
- If the building has 3-phase AC power, try to ensure that equipment connected to the Local and Remote Units is on the same phase.
- Try not to route the CATx interconnection cable alongside power cables.
- The use of shielded CATx cable is recommended to maintain compliance.
- Ensure that the system connected to the Local Unit is connected to power ground.
- Ensure that the monitor connected to the Remote Unit is connected to power ground.
- The Remote Unit and any power supplies can get warm. Do not situate them in an enclosed space without any airflow.
- Do not place the power supply directly on top of the Remote Unit.
- This product is not suitable for use in isolated medical environments.



To safeguard against personal injury and avoid possible damage to equipment or property, please observe the following:

- Only use power supplies originally supplied with the product or manufacturer-approved replacements. Do not attempt to dismantle or repair any power supply. Do not use a power supply if it appears to be defective or has a damaged case.
- Connect all power supplies to grounded outlets. In each case, ensure that the ground connection is maintained from the outlet socket through to the power supply's AC power input.
- Do not attempt to modify or repair this product, or make a connection from the CATx link interface (RJ45) to any other products, especially telecommunications or network equipment.

Contents

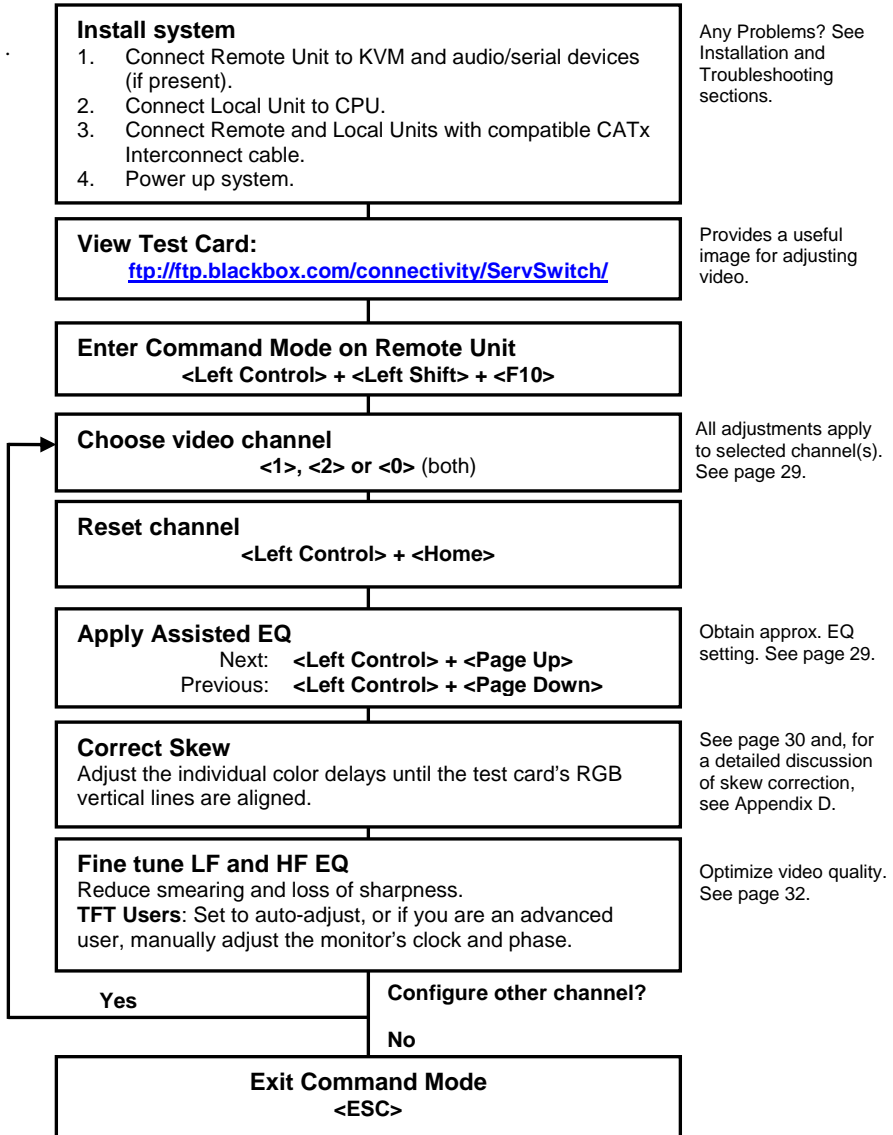
1. Quick Setup	10
1.1 Command Summary	11
2. Overview	12
2.1 Introduction	12
2.2 Glossary	12
2.3 Features	14
2.4 Product Range	15
2.5 Compatibility	16
2.6 How to Use This Guide	17
3. Installation	18
3.1 Package Contents	18
3.2 Interconnection Cable Requirements	19
3.3 Remote Unit Installation	20
3.4 Local Unit Installation	22
4. Remote Unit Configuration & Operation	25
4.1 Video Configuration Overview	25
4.2 Video Adjustments	26
4.3 Command Mode	27
4.4 Adjusting Video	28
4.5 Other Remote Configuration & Operation Options	33
5. Troubleshooting & FAQ	37
5.1 Video	37
5.2 USB	39
5.3 Audio	40
5.4 Serial	40
5.5 General Questions	41

Appendix A: Example Application	42
Appendix B: Rack Mount Options	43
Appendix C: Flash Upgrading	44
Appendix D: Advanced Cabling Issues (Skew)	48
Appendix E: Audio/Serial Ports	51
Appendix F: Calling Black Box	53
Appendix G: Specifications	54
Appendix H: New Features	57
Enhanced Keyboard & Mouse Support (v2.0)	58
Generic HID Device Support (v2.0)	58
Private Mode (v2.0)	59
Enhanced Elo Touch Screen Support/Calibration (v2.3)	61

Appendix H: New Features

1. Quick Setup

This section briefly describes how to install your KVM extender system and optimize the video signals. Unless you are an experienced user, we recommend that you follow the full procedures described in the rest of this manual. Refer to the command summary on the next page when following this procedure.



1.1 Command Summary

By using a specific ‘hot’ key sequence, you can put the remote console keyboard into a Command Mode. From this, you can use various keys and key combinations to tune the video signal and generally configure the extender system. The following table summarizes most of the ‘hot’ key command sequences used in system configuration and video tuning.

Command Mode	
Enter Command Mode	<Left Control> + <Left Shift> + <F10>
Exit Command Mode & Save	<ESC>
Exit Command Mode Without Save	<Left Control> + <ESC>
Video Channel Selection	
Select Channel For Adjustment	<1>, <2>
Select BOTH Video Channels	<0>
Assisted EQ	
Next Assisted EQ Setting	<Left Control> + <Page Up>
Previous Assisted EQ Setting	<Left Control> + <Page Down>
Reset EQ & Delay Values	<Left Control> + <Home>
Reset EQ Values	<Left Control> + <End>
LF/HF Equalization	
Increase LF Equalization (Coarse)	<L> + <Up Arrow>
Increase LF Equalization (Fine)	<L> + <Right Arrow>
Decrease LF Equalization (Coarse)	<L> + <Down Arrow>
Decrease LF Equalization (Fine)	<L> + <Left Arrow>
Increase HF Equalization (Coarse)	<H> + <Up Arrow>
Increase HF Equalization (Fine)	<H> + <Right Arrow>
Decrease HF Equalization (Coarse)	<H> + <Down Arrow>
Decrease HF Equalization (Fine)	<H> + <Left Arrow>
Quick Skew	
Toggle RED Delay (19nS)	<Left Control> + <R>
Toggle GREEN Delay (19nS)	<Left Control> + <G>
Toggle BLUE Delay (19nS)	<Left Control> +
Delay (Skew)	
Increase RED Delay	<R> + <Right Arrow>
Increase GREEN Delay	<G> + <Right Arrow>
Increase BLUE Delay	 + <Right Arrow>
Decrease RED Delay	<R> + <Left Arrow>
Decrease GREEN Delay	<G> + <Left Arrow>
Decrease BLUE Delay	 + <Left Arrow>
Reset Commands	
Set Extender To Default State	<Left Control> + <F9>
Other Commands	
Toggle Remote Unit Private Mode	<Scroll Lock>
USB Device Registration (Descriptor Transfer)	<Left Control> + <F4>
Set USB KB Language ID	<Left Control> + <F3>
Disable DDC Emulation	<Left Control> + <F2>
Enable DDC Emulation	<F2>
Transfer DDC from monitor to Local Unit	<Left Control> + <D>
Enter Upgrade Mode	<Left Control> + <Left Shift> + <Right Shift> + <F9>

2. Overview

2.1 Introduction

The ServSwitch™ Brand CATx KVM Extender Series enables high-resolution video, USB keyboard and mouse/HID, stereo audio, and serial port signals to be communicated up to 1000ft (300m) over Category 5, 5e, 6 or higher (CATx) cable.

A basic KVM extension system comprises a *Local Unit* (transmitter) and a *Remote Unit* (receiver). The Local Unit connects directly to the computer (or a KVM switch system) using the supplied cable(s). The user *console* (USB devices and monitors) attaches to the Remote Unit. All Local Units in this series have video output ports, allowing a second user console at the CPU (using further CPU USB ports). The Remote and Local Units communicate video and data information along the connecting CATx cables (see Figure 1).

Within the product range, models are available with combinations of the following:

- Audio transmission: bi-directional stereo audio (16-bit digitized).
- Serial transmission: transparent serial COM port (to 19.2Kbps).
- Multiple video channels: single and dual heads.

2.2 Glossary

The following terms are used in this guide:

CATx	Any Category 5, 5e, 6 or higher cable.
PSU	Power Supply Unit.
KVM	Keyboard, Video and Mouse.
HID	USB Human Interface Device such as a Keyboard, Mouse, Touch Screen, Joystick, Barcode Reader etc.
Console	A keyboard, monitor, and mouse, plus optional serial/audio/USB devices.
Single Head	An extender system that supports one remote monitor
Dual Head	An extender system that supports two remote monitors.

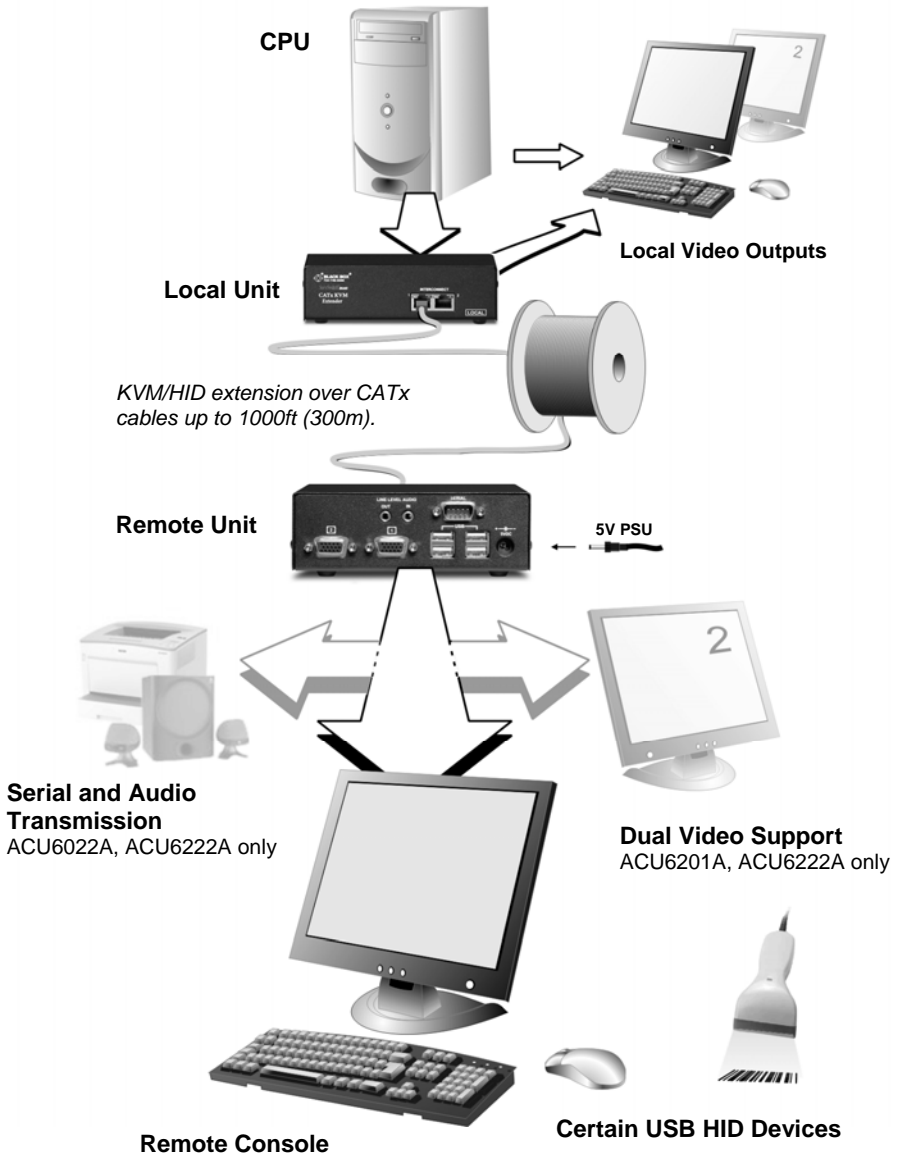


Figure 1 KVM/HID extender system

2.3 Features

Members of the ServSwitch™ Brand CATx KVM Extender Series offer the following features:

- Support for USB keyboards, mice and certain other HID devices
- Support for high video resolution for use with TFT displays:
1600x1200@60Hz over 650ft (200m)
1280x1024@75Hz over 1000ft (300m)
Higher resolutions may be possible at shorter distances.
- Fully integrated skew compensation allows operation with CATx cables by canceling color shift and enhancing sharpness.
- Independent low frequency (LF) and high frequency (HF) cable equalization control ensures optimum video tuning across different cable types.
- All control and video tuning carried out using the remote console keyboard with settings stored in EEPROM memory.
- Emulated DDC (Display Data Channel) on all video channels
Extender Local Unit emulates a universal monitor; ensures compatibility with multi-head graphics cards
- Transparent DDC
Remote Unit reads DDC table from attached monitors, transfers and stores data in Local Unit to support non-standard displays.
- Local Video output on all video channels
Allows dual-access operation when a local USB keyboard and mouse are connected directly to the CPU (or via a hub)
- Local and Remote Unit firmware and settings flash upgradeable via USB.
- Models available with single or dual-head video support (one CATx cable required for each video channel).
- Status indicator LEDs on each RJ45 port.
- Small footprint chassis. Rack mount options available.
- Protection: Surge protection on each RJ45 port and PSU overvoltage detection.
- Local Units are normally powered directly by the PC. Connection for optional 5V PSU.
- Transparent serial port enables any serial device to be extended (up to 19.2K Baud). The serial port may be used to extend one device (requiring handshaking lines), or up to three simple serial devices (no handshaking).
(ACU6022A and ACU6222A only)
- Bi-directional stereo audio (16-bit digitized) support enables high-quality audio extension.
(ACU6022A and ACU6222A only)

2.4 Product Range

There are four products in the range:

Single Video Channel Kit (Standard)

ACU6001A	Single Video Channel, USB Keyboard/Mouse (HID) Local Unit + Remote Unit
----------	--

Single Video Channel Kit (Audio)

ACU6022A	Single Video Channel, USB Keyboard/Mouse (HID) Serial, Stereo Audio Local Unit + Remote Unit
----------	--

Dual Video Channel Kit (Standard)

ACU6201A	Dual Video Channels, USB Keyboard/Mouse (HID) Local Unit + Remote Unit (Dual Video)
----------	--

Dual Video Channel Kit (Audio)

ACU6222A	Dual Video Channels, USB Keyboard/Mouse (HID) Serial, Stereo Audio Local Unit + Remote Unit (Dual Video)
----------	--

2.5 Compatibility

Interface Compatibility

- **USB Devices:**

- Standard keyboards (including certain models with multimedia keys)
- Standard wheel mice (including certain models with tilt wheel)
- Composite keyboard/mouse devices (e.g. wireless devices & KVM switches)
- PS/2 to USB converters
- Hubs
- Other keyboard/mouse type devices such as bar code scanners

Several devices of the same type may be attached simultaneously.

Other HID devices which only send to the host, and can operate using the basic HID drivers built into the operating system. Typical devices include joysticks and certain touch screens. Additional support is included in the latest firmware revisions for ELO touch screen calibration. See Appendix H: New Features **Appendix H: New Features**, page 57.

Please contact Technical Support for further information regarding operation with other kinds of HID device not listed above.

- **Audio:** Input and output are line-level. Amplified speakers are required. A microphone may be directly connected to the Remote Unit (optional pre-amplification).
- **Serial:** Transparent up to 19.2K Baud (38.4K operation may be possible with some devices). The following serial signals are extended: TX, RX, RTS, CTS, DTR, and DSR. In rare cases, a wiring adaptor may be required to transfer RI and DCD.
- **Video:** VGA to UXGA. Separate sync, composite sync, or sync-on-green. Maximum resolution and refresh rates depend on cable length and cable type (see **Appendix G: Specifications**, page 54).

Extender Compatibility

Please refer to **Have** section, page 37. You may also consult Technical Support to confirm compatibility with other ServSwitch™ Brand extension and switching products.

2.6 How to Use This Guide

This guide describes the installation and configuration of the ServSwitch™ Brand CATx KVM Extender Series. Although the connection and operation of the system is relatively straightforward, you should consider the following before getting started:

Connection & Compatibility

Your Extender Kit contains all the cables required to connect the Local Unit to your PC or KVM switch. The remote console (keyboard, monitor and mouse) and any audio and serial equipment connect directly to the Remote Unit.

For information about connection and installation, see **Installation**, page 18.

Interconnection Cable

You will need CATx (any category 5, 5e, 6 or higher) cable, terminated with RJ45 plugs, to connect the Local and Remote Units (see **Interconnection Cable Requirements**, page 19).

Adjusting Video

Video signals become distorted when transmitted over CATx cables. To get the best from your extender system, it is *essential* that you adjust the Remote Unit to optimize the video image quality:

- For experienced users, there is a **Quick Setup** section at the start of this guide (see page 10).
- For the full procedure, see **Remote Unit Configuration & Operation**, page 25.
- Refer to **Appendix D: Advanced Cabling Issues (Skew)**, page 48 for a more in depth discussion of skew correction and advanced cabling issues.

3. Installation

For first-time users, we recommend that you carry out a test placement, confined to a single room, before commencing full installation. This will allow you to identify and solve any cabling problems, and experiment with the KVM extender system more conveniently.

3.1 Package Contents

You should receive the following items in your extender package. If anything is missing, please refer to Appendix F to obtain Technical Support.

- Extender Remote Unit.
- 5V DC universal power supply for Remote Unit.
- Extender Local Unit.
- 3ft (1.0m) USB/Video CPU combination cable with USB (A/B) connectors and VGA video (HD15 M-F) connectors.
- 3ft (1.0m) CPU video cable with VGA video (HD15 M-F) connector.
Models: ACU6201A and ACU6222A only.
- 3ft (1.0m) Serial cable (DB9 M-F connectors, 1:1 connections).
Models: ACU6022A and ACU6222A only.
- 3ft (1.0m) Dual stereo audio cable (3.5mm stereo plugs).
Models: ACU6022A and ACU6222A only.
- IEC AC Power Cord.
- Quick Start Guide.

3.2 Interconnection Cable Requirements

To connect the Local and Remote Units you will need CATx (any category 5, 5e, 6 or higher) cable terminated with RJ45 plugs. Please note that shielded cable is advised to maintain regulatory EMC compliance.

Interconnect cables must be solid-core type. Stranded patch cable will give poor results over longer distances. The pairing of the cable and pinning of its connectors should normally be in accordance with EIA-568B (see page 49).

One CATx cable is required for each video channel.

- The *Primary* interconnect cable connects INTERCONNECT Port 1 on the Local and Remote Units. This carries the main video channel and all data (plus audio/serial).
- The *Secondary* CATx cable (connected to INTERCONNECT Port 2) carries the additional video channel on dual-head units.



In order to send USB, Audio and Serial signals to the PC, the Primary interconnect must be connected.

The Primary interconnect does not have to be connected in order to use the keyboard attached to the Remote Unit for video setup.

*With some cables, video performance may be improved by using a crossover patch cable at each end or an alternative RJ45 pin-out (see **Appendix D: Advanced Cabling Issues (Skew)**, page 48).*

3.3 Remote Unit Installation

To install a Remote Unit:

1. Switch off all devices.
2. Connect your USB devices and monitor(s) to the Remote Unit as shown in Figure 2.



These ports may also be attached to the CPU side of a KVM switch in order to have a remote CPU. However, if you are attempting to use the extender between cascaded KVM switches this may not work. Please contact Technical Support to discuss your application.

3. If appropriate, connect audio equipment and serial devices. Connect the audio cables as follows:

<i>Remote Unit</i>	<i>Audio Device</i>
Audio Out	Speakers
Audio In (MIC)	Microphone

See **Appendix E: Audio/Serial Ports**, page 51 for further information.

4. Connect the Primary CATx cable to the INTERCONNECT (1) socket on the front of the Remote Unit. If required, connect the Secondary CATx cable to the INTERCONNECT (2) socket on the front of the Remote Unit (see Figure 3).
5. Connect the 5V power supply to power the unit.



Only use the power supply originally supplied with this equipment or a manufacturer approved replacement.

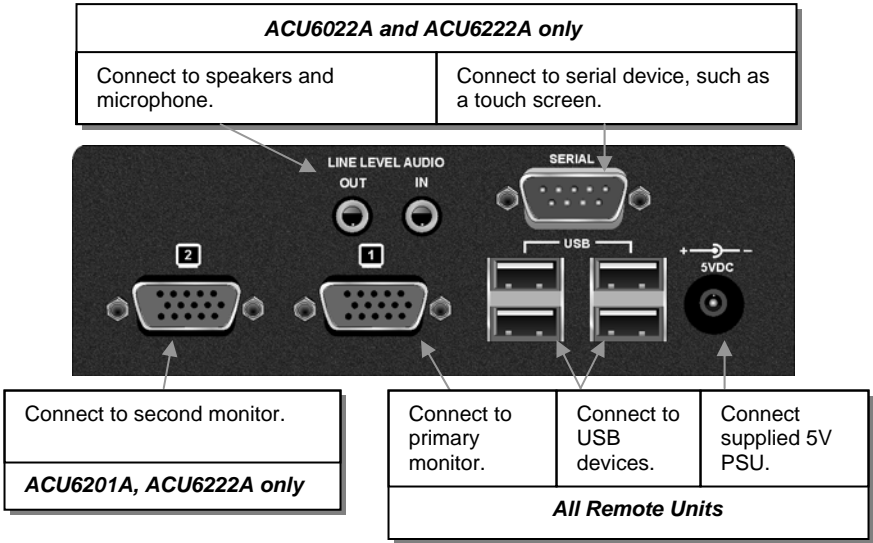
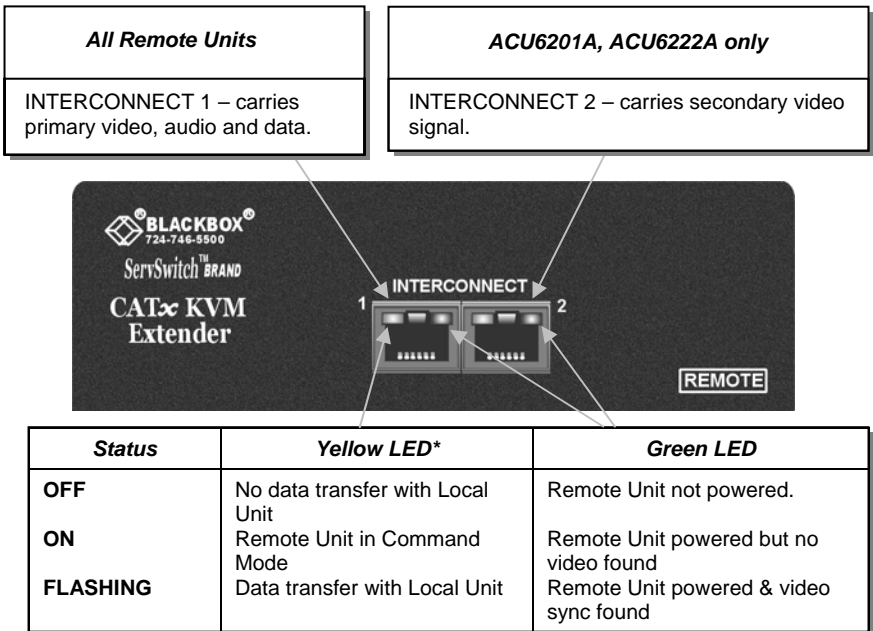


Figure 2 Remote Unit - rear view



* Yellow LED active on primary INTERCONNECT socket (Channel 1) only

Figure 3 Remote Unit - front view

3.4 Local Unit Installation

To install a Local Unit:

1. It is recommended that the PC and other devices are switched off before connection.
2. Using the supplied CPU video/USB cable(s), connect the Local Unit to the CPU as shown in Figure 4.
3. If you want local access to the CPU, connect the video output(s) on the Local Unit to suitable monitors. Connect a USB mouse and a USB keyboard directly to other USB ports on the CPU or a connected hub.
4. If you have an audio and serial enabled system, connect the audio cables between the computer and Local Unit as follows:

<i>Computer</i>	<i>Local Unit</i>
Audio Out (green)	Audio In
Audio In/Microphone (pink/blue)	Audio Out

5. If appropriate, connect the supplied serial cable between the serial port on the computer and the Local Unit.
6. For single video units, connect the CATx cable to the INTERCONNECT socket on the front of the Local Unit. For dual-head systems, connect the CATx cables from the Remote Unit to the corresponding INTERCONNECT ports (1&2) on the Local Unit (see Figure 5).
7. Power up the PC.



The Local Unit normally takes power through the USB port. In video only applications, or cases where only limited port power is available, an external power supply may be attached (PSU1006E-R3). Please contact Technical Support for more details.

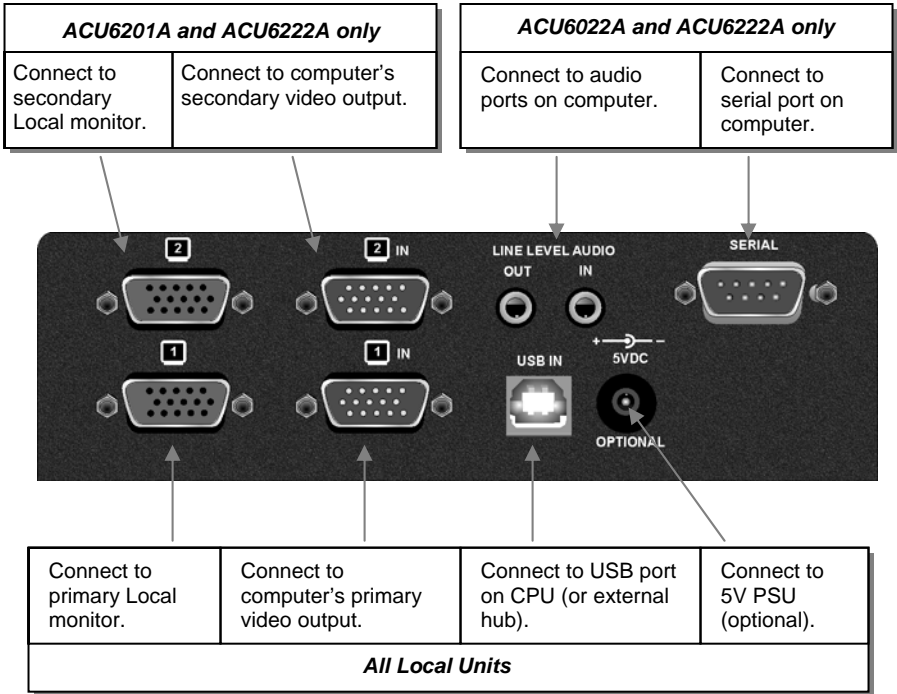
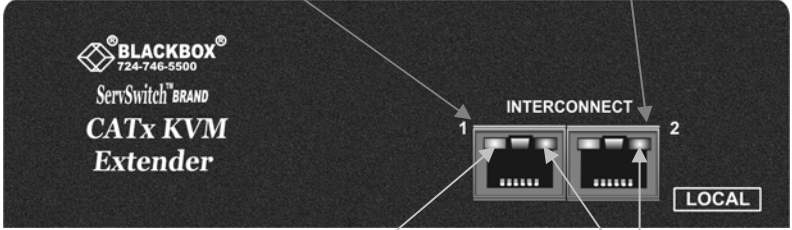


Figure 4 Local Unit - rear view

SERVSWITCH™ BRAND CATx KVM EXTENDER FAMILY

All Models	ACU6201A and ACU6222A only
INTERCONNECT 1 – carries primary video, audio and data signals. Connect to CATx cable from INTERCONNECT 1 port on Remote Unit.	INTERCONNECT 2 – carries secondary video signals. Connect to CATx cable from INTERCONNECT 2 port on Remote Unit.



Status	Yellow LED*	Green LED
OFF	No data transfer with Remote Unit	Local Unit not powered.
ON	Local Unit in Command Mode	Local Unit powered
FLASHING	Data transfer with Remote Unit	

* Yellow LED active on primary INTERCONNECT socket (Channel 1) only

Figure 5 **Local Unit - front view**

4. Remote Unit Configuration & Operation

CATx cables are specifically designed for networking applications and not for transmitting analog video. Your CATx KVM extender includes, and requires, advanced technology to enable its use at high screen resolutions. This section describes how to optimize the video signal, configure the Extender system and operate the Remote Unit.

For details about flash upgrading and external configuration see **Appendix C: Flash Upgrading & External Configuration**, page 44.

For more information about serial/audio port operation, see **Appendix E: Audio/Serial Ports**, page 51.

4.1 Video Configuration Overview

To get the best out of your extender system it is *essential* that you configure it correctly and tune the video signal. Tuning is necessary because of distortions that occur in a video signal when it is transmitted over lengthy CATx cables. Generally, you only need to carry out this procedure after installation. The system stores settings in an EEPROM in the Remote Unit and restores them whenever the unit is powered up.

When you have installed your extender system, run an application that requires a high screen resolution. Examine the video image on the remote console's monitor. You may see some of the following distortion effects:



Smearing: black smearing at the right-hand edge of large horizontal objects such as title bars and characters. To correct this smearing requires adjustment of *LF equalization*.



Loss of Sharpness: Loss of high frequency (HF) signals causes blurring and lack of detail. To correct this requires adjustment of *HF equalization*.



Color Separation or Skew: This arises because of timing differences in the reception of signals for the individual colors. Each color in the RGB (Red, Green, Blue) video signal is sent down a separate pair of wires in the Interconnect cable. On many cables, the twist rates differ and this leads to each color arriving at a slightly different time and therefore spreading out on the screen. Skew becomes a major problem at high screen resolutions and with long CATx cables. To correct for skew, the 'faster' colors must be delayed to arrive at the same time as the slowest.

4.2 Video Adjustments

Remote Units feature a number of correction tools to simplify video optimization. This procedure is straightforward and only needs to be carried out once.

For each video channel, the Remote Unit allows you to optimize independently:

- Low frequency (LF) equalization
- High frequency (HF) equalization
- Red delay
- Green delay
- Blue delay

To help automate the procedure, the Remote Unit offers the following unique tools:

- ***Assisted EQ***
Allows you to 'step-through' a table of preset LF and HF EQ values for different cable lengths.
- ***Quick Skew***
Insert a standard delay on a specified color (19ns - a typical value suitable for most applications).
- ***Channel 0***
Enables you to apply video adjustments to both video channels simultaneously.

To get the best video image, you are recommended to follow the procedures for manual fine-tuning (see **Adjusting Video**, page 28).



*You may want to read **Appendix D: Advanced Cabling Issues (Skew)** on page 48 to understand how to achieve optimum video quality with your particular CATx interconnection cable.*

4.3 Command Mode

During normal use, the remote console keyboard functions in the usual manner. However, by using a specific ‘hot’ key sequence, you can set the keyboard into a Command Mode. From this, you can use various keys and key combinations to tune the video signal and generally configure the extender system.

To enter Command Mode:

8. Ensure that you have installed and powered up the system according to the instructions in Section 3.
9. Press the following key combination on the remote keyboard:

<Left Control> + <Left Shift> + <F10>

From Command Mode you can use one or more of the ‘hot’ key sequences shown on page 11 to configure the system. The next section gives a full description of the video optimization procedure.

To exit Command Mode:

- Press <Esc> to exit Command Mode and save the configuration settings, or
- Press <Left Control> + <Esc> to exit Command Mode without saving changes made in the current session.



The Remote Unit automatically exits Command Mode after 30 sec of inactivity, saves all settings to EEPROM and returns normal function to the keyboard.

Status LEDs in Command Mode

In Command Mode, the Remote Unit:

- Illuminates the yellow channel 1 LED continuously (see Figure 5).
Note. The Yellow LEDs on video channel 2 is not lit.
- Flashes the status LEDs (Num Lock, Caps Lock, Scroll Lock) on the connected keyboard to indicate video channel selection (to which adjustments will be applied).

The number of flashes indicates the selected video channel:

<i>Keyboard LED flashes</i>	<i>Video channel</i>
1	Channel 1
2	Channel 2 (dual-head only)
Slow Flashes	Both channels (<i>Channel 0</i>)

4.4 Adjusting Video

Use the following step-by-step procedure to optimize the video image on the remote console:

1. If possible, view the online test card at:

<ftp://ftp.blackbox.com/connectivity/ServSwitch/>

This is an image (see Figure 6) created and used by the manufacturer for video optimization purposes. It is particularly useful for correcting skew. If you are unable to view the test card, display some text in a large font on a white background.



You should also open up other application windows to check the clarity of text in toolbars and icons on the desktop.

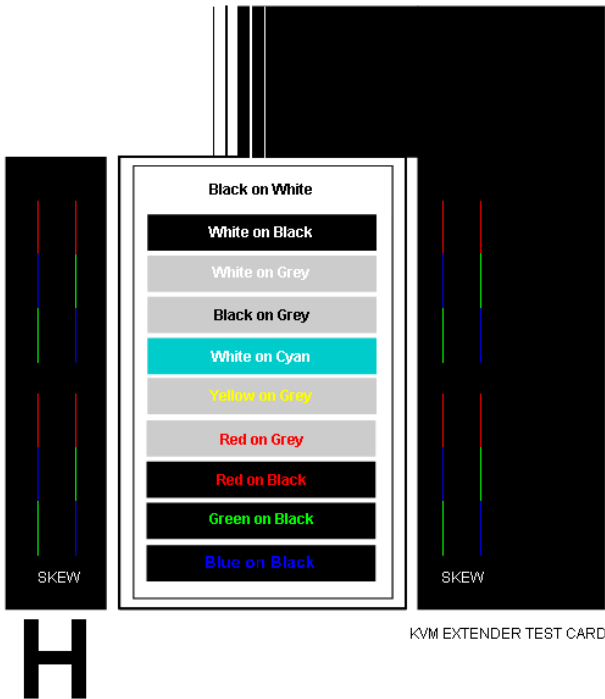


Figure 6 Online test card

REMOTE UNIT CONFIGURATION & OPERATION

2. Enter Command Mode (see **Command Mode**, page 27) by pressing the following key combination on the remote console's keyboard:

<Left Control> + <Left Shift> + <F10>

3. Select the video channel you want to configure using one of the following keys (*not* on the numeric keypad):

<i>Channel Command</i>	<i>Key</i>
Select Channel 1 For Adjustment	<1>
Select Channel 2 For Adjustment	<2>
Select BOTH Video Channels	<0> (<i>Channel 0</i>)



*Use **Channel 0** to tune both video channels simultaneously. This simplifies the procedure for setting up dual-head installations where a consistent cable type is used and the adjustments required should be almost the same.*

4. Reset the selected channel(s) by pressing:

<Left Control> + <Home>

5. Step through the *Assisted EQ* settings to find the level that gives the best image.

<i>Assisted EQ Command</i>	<i>Key Sequence</i>
Next Assisted EQ Setting	<Left Control> + <Page Up>
Previous Assisted EQ Setting	<Left Control> + <Page Down>



***Assisted EQ** steps through a table of preset **LF** & **HF** EQ values for different lengths of cable (in 80ft {25m} increments calibrated from 0 to 1250ft {375m}). Each time you enter Command Mode and start adjusting Assisted EQ, the unit resets **LF** and **HF** values.*

*After finding the best setting, you will probably want to fine-tune the **LF** and **HF** equalization settings (see steps 8&9). This is best done after adjusting for any color skew as described below.*

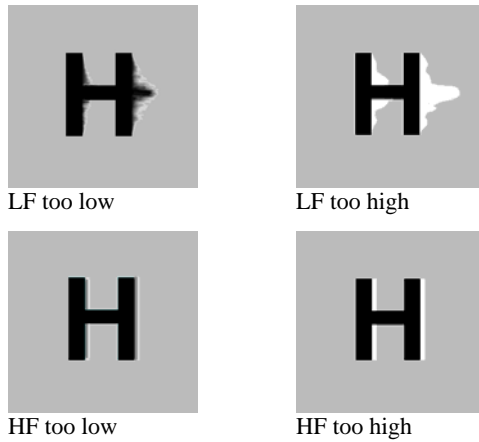


Figure 7 **Problems with smearing and sharpness requiring LF and HF adjustment**

6. Identify the ‘slowest’ color – the colored line furthest to the right. Delay the signals of the two other colors using the following commands:

<i>Delay Command</i>	<i>Key Sequence</i>
Increase RED Delay (move right)	<R> + <Right Arrow>
Decrease RED Delay (move left)	<R> + <Left Arrow>
Increase GREEN Delay (move right)	<G> + <Right Arrow>
Decrease GREEN Delay (move left)	<G> + <Left Arrow>
Increase BLUE Delay (move right)	 + <Right Arrow>
Decrease BLUE Delay (move left)	 + <Left Arrow>

Use the *Quick Skew* feature to determine which color requires delaying or to quickly set the delay on a color back to zero. Applying *Quick Skew* to a color toggles its delay between zero and 19nS (a typically required value).

<i>Quick Skew Command</i>	<i>Key Sequence</i>
Toggle RED Delay	<Left Control> + <R>
Toggle GREEN Delay	<Left Control> + <G>
Toggle BLUE Delay	<Left Control> +

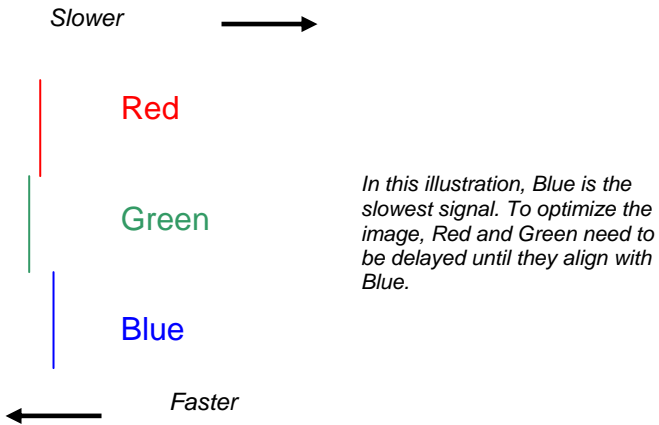


Figure 8 Illustration of skew and appearance on test card



*Some Cat5e/Cat6 cables require a large green delay. Video quality can be often be vastly improved by using standard crossover patch cables at both ends of the link rather than straight patch cables. For details see **Appendix D: Advanced Cabling Issues (Skew)**, page 48.*

Sometimes the optimum skew adjustment will actually be one step out from that suggested by the test card due to the way some monitors sample the signal.

The maximum amount of skew correction available is 42nS. This is more than adequate for the vast majority of cables. However, it may not be enough if you are using a particularly long run of a cable which exhibits severe delay skew.

- If you are using one or more flat panel monitors in the remote console, carry out auto-adjustment as described in the monitor’s documentation. Sometimes, manual adjustment of clock and/or phase is also required for optimum results and minimization of jitter.**

8. Optionally, fine-tune the LF equalization to remove ‘black video smearing’ - black smears to the right of large objects such as window title bars (see Figure 7).

<i>LF Equalization Commands</i>	<i>Key Sequence</i>
Increase LF Equalization (Coarse)	<L> + <Up Arrow>
Decrease LF Equalization (Coarse)	<L> + <Down Arrow>
Increase LF Equalization (Fine)	<L> + <Right Arrow>
Decrease LF Equalization (Fine)	<L> + <Left Arrow>

9. Optionally, fine-tune the HF equalization to sharpen the video image. Increase HF Equalization until a white edge to the right of small characters just starts to appear (see Figure 7).

<i>HF Equalization Commands</i>	<i>Key Sequence</i>
Increase HF Equalization (Coarse)	<H> + <Up Arrow>
Decrease HF Equalization (Coarse)	<H> + <Down Arrow>
Increase HF Equalization (Fine)	<H> + <Right Arrow>
Decrease HF Equalization (Fine)	<H> + <Left Arrow>



On certain monitors, you may obtain a sharper image by overcompensating HF EQ and then decreasing LF EQ to remove any bright streaks. Additionally, increasing the contrast on the monitor can also enhance apparent image quality.

10. If you are using one or more flat panel monitors in the remote consoles, carry out auto-adjustment again.
11. Save the settings by pressing the <Esc> key. Alternatively, to discard any changes and revert to the settings stored in the EEPROM, press <Left Control> + <Esc>. The Remote Unit automatically exits Command Mode after 30 sec of inactivity and saves all settings, including any changes.

4.5 Other Remote Configuration & Operation Options

The ServSwitch™ Brand CATx KVM Extender Series have a number of configuration commands to setup USB, to reset EQ and Delay values, to restore the factory default configuration, change DDC settings, and to blank monitors (Private Mode).

Also refer to **Appendix H: New Features**, page 57 for details of additional features added in later firmware revisions.

<i>Command</i>	<i>Key Sequence</i>
<i>Toggle Remote Unit Private Mode</i>	<Scroll Lock>
Use this command to enable/disable the monitor(s) connected to the Local Unit (Private Mode). The current setting is stored in memory.	
<i>Set USB KB Language ID</i>	<Left Control> + <F3>
This is not normally required but some operating systems (such as Solaris) require a language ID to determine the KB layout (see page 35).	
<i>USB Device Registration (Descriptor Transfer)</i>	<Left Control> + <F4>
To support multimedia keys, joysticks, touch screens, and certain other HID devices, USB descriptors need to be read from the connected devices and transferred to the Local Unit (see page 35).	
<i>Set Extender To Default State</i>	<Left Control> + <F9>
Sets ALL extender settings (video & configuration) back to the factory defaults.	
<i>Reset EQ Values</i>	<Left Control> + <End>
You can use this command to zero HF & LF EQ values for the selected video channel(s). Current color delay values are not affected.	
<i>Reset EQ & Delay Values</i>	<Left Control> + <Home>
Set all video EQ (HF & LF) and color delay values to zero for the currently selected video channel(s). You can use this command to reset EQ and delay values for all video channels in a multi-head installation by selecting <i>Channel 0</i> prior to issuing this command.	
<i>Disable DDC Emulation</i>	<Left Control> + <F2>
By default, the Local Unit provides DDC emulation on both video channels. Use this command to disable DDC emulation.	
<i>Enable DDC Emulation</i>	<F2>
Use this command to restore DDC emulation.	
<i>Transfer DDC to Local Unit</i>	<Left Control> + <D>
Read DDC from monitor connected to Remote Unit video channel 1 and apply to selected video channels in Local Unit (see page 34).	

DDC Emulation

Modern graphics cards use VESA DDC (Display Data Channel) to identify the capabilities of connected monitors. Some cards will not operate correctly unless they communicate with a DDC-enabled monitor.

By default, the Local Unit emulates a universal monitor (on both channels) and reports that it is capable of all standard screen resolutions and refresh rates (including several widescreen modes). This ensures that the vast majority of graphics cards and monitors should operate correctly with the extender system.

The DDC emulation can be optionally disabled but this would only be required in special applications.

If you encounter a situation where the default DDC emulation is not sufficient and cannot obtain the required graphics mode, information from the remote monitor(s) may be read and stored in the Local Unit using the Transfer DDC command.

Transferring DDC Information

To support non-standard screen settings or other features, it is possible to read and store DDC information into the Local Unit directly from the monitors connected to the Remote Unit. You only need to carry out this procedure once; the Extender Units store the DDC information in non-volatile memory and restore it at power-up.

1. Ensure that you have installed and powered up the system according to the instructions in Section 3.
2. Connect the monitor to the 'monitor 1' socket on the Remote Unit (see Figure 2).
3. Enter Command mode (see page 27).
4. Select the video channel to which you want to apply the DDC settings by pressing either <1>, <2> or <0> (both channels).
5. Press the key combination:
<Left Control> + <D>
6. The DDC information is read from the monitor and applied to the selected video channel(s) in the Local Unit. This may take a few seconds. The remote console keyboard LEDs flash twice to indicate a successful transfer.



Always reboot Windows after adjusting a DDC parameter.

Setting USB keyboard Language ID

This is not normally required, but some operating systems (such as Solaris) require a language ID to determine the KB layout. This command will read the ID from the current KB (the one used to enter Command mode) and permanently store it.

1. Enter Command mode (see page 27).
2. Press the key combination:

<Left Control> + <F3>

The Remote Unit will now exit Command mode whilst the Local Unit re-connects as a keyboard with the desired ID. During this time you will be unable to use the keyboard and mouse.

Should any problems arise after issuing the command, simply USB hot-plug the Local Unit.

USB Device Registration (Descriptor Transfer)

By default the Local Unit emulates a *standard* USB keyboard and mouse (composite device). Whilst this is sufficient for general KVM use, additional information needs to be transferred in order to support *non-standard* (device specific) features and other HID peripherals ^{See Note}.

Device registration is required to help support:

- Keyboards with additional multimedia keys
- Mice with enhanced functionality ^{See Note}
- Joysticks ^{See Note}
- Touch Screens ^{See Note}
- Certain other HID devices ^{See Note}

This feature allows the report definition to be read from your HID devices and permanently stored within the Local Unit (Descriptor Transfer).



*In initial firmware releases Device Registration was limited to enabling support for multimedia keys on the current keyboard. Please refer to **Appendix H: New Features**, page 57 for details regarding support in later firmware releases for a wider range of HID devices.*

To register generic devices:

1. Enter Command mode (see page 27).
2. Press the key combination:

<Left Control> + <F4>

The Remote Unit will now exit Command mode whilst the Local Unit re-connects as a device with the transferred descriptors. During this time you will be unable to use USB devices.

Should any problems arise after issuing the command, simply USB hot-plug the Local Unit.

Each time you issue this command all of the additional HID devices you wish to register must be connected as details of the previous registration are overwritten. Registration only needs to be performed once.



USB Device Registration will enable operation with any generic HID device that only sends data to the host, and does not require a vendor driver (i.e. it can utilize the operating system's own HID driver).

*If an HID device **requires** a special driver, or your keyboard has multimedia keys that also function as normal keys then it is unlikely to be fully supported by the extender.*

*Please refer to **Appendix H: New Features**, page 57 and check with Technical Support regarding the availability of later firmware releases supporting a wider range of HID devices.*

5. Troubleshooting & FAQ

5.1 Video

The image is not sharp, or is badly smeared.

Have you adjusted the video equalization? Follow the instructions on page 26.

Check the Interconnect cable between the Remote and Local Units. Is it of the recommended type (see page 19)? Is it intact along its entire length and securely connected at both ends? Is it wired correctly (see page 49)?

Ensure that all video connections throughout the system are attached securely.

Are you using an LCD panel? You need to adjust its clock and/or phase.

Colors appear to be separated and there are colored borders on text and icons.

Have you tuned the video signal and set delays to correct skew? Follow the instructions on page 26. See Appendix D for advanced cabling information.

Check the Interconnect cable between the Remote and Local Units. Is it of the recommended type (see page 19)? Is it intact along its entire length and securely connected at both ends? Is it wired correctly (see page 49)?

You can check whether skew is a problem in your system by viewing the test card at: <ftp://ftp.blackbox.com/connectivity/ServSwitch/>.

I can't get enough color delay to correct skew.

See **Appendix D: Advanced Cabling Issues (Skew)**, page 48.

I can't get rid of bright 'ringing' after characters.

See **Appendix D: Advanced Cabling Issues (Skew)**, page 48.

I only need video extension – not keyboard or mouse - but I can't get a picture.

Have you powered the Local Unit? The Local Unit gets its power from the CPU through the USB connection and it will not operate without it. Use an external 5V PSU as described on page 22.

The maximum resolution is listed as 1600x1200. Can I use 1920x1200 or 1680x1050?

Yes. As this is an analog extender there is no inherent resolution limit. Many users are running 1920x1200 over shorter distance. With a good low-skew cable the range could be up to 450ft (150m).

If in doubt – please test it!

The monitor sometimes goes blank for a second or two.

Check that the interconnect cable is not routed near power lines or other sources of electrical interference. Use shielded STP/FTP cable instead of UTP cable ensuring that the shield connection is maintained between the Extender units.

If this is a persistent problem, contact Technical Support.

The PC won't boot into the correct graphics mode.

Check that DDC Emulation is enabled (see page 34). If you are using a non-standard resolution, transfer the monitor's DDC information to the Local Unit (see page 34).

Jitter is evident on video.

Adjust the clock and/or phase on your flat-panel. Contact Technical Support if this fails to improve the situation.

Are you testing a system using a coiled drum of CATx cable? Try uncoiling the cable. If this solves the video jitter, you should not have a problem after full installation.

The image is not stable and is blanking regularly.

Re-power the Remote Unit.

Can the extender be used with RGB video?

Yes.

Can the extender be used with Analog HD video?

Yes, with the aid of a suitable wiring adaptor.

There is a slight color change when I increase delays to correct skew.

With certain monitors, there may be a *slight* color change when you increase the color delay. This is due to a contrast change on that particular color and may easily be compensated for by adjusting the monitor's color balance.

5.2 USB

Does the extender internally convert to PS/2 when handling keyboard and mouse?

No. This is a pure USB (emulation) solution. Converting to PS/2 would restrict the possibilities of supporting other kinds of USB device.

Will the extender work with USB KVM switches?

The extender will operate with any USB KVM switch that is capable of supporting both a mouse and keyboard composite device on its keyboard console port. Some low-end switches only support a single keyboard device on this port in which case there will be no mouse functionality when attaching the extender.

Is the extender a USB 1.1 or USB 2.0 device?

The extender operates as a full-speed composite USB device (12 Mb/s); this is compatible with *any* USB 1.1 or 2.0 host. There may be some low-end KVM equipment on the market that does not fully support composite devices and can only handle low-speed devices. We will monitor the compatibility situation.

What USB devices are supported?

In the initial firmware release the following HID devices are supported:

- Standard keyboards
- Multimedia keys on some keyboards
- Standard mice (including wheel)
- USB – PS/2 converters
- Composite KB/Mouse devices
- Hubs
- Other keyboard/mouse compatible devices (such as bar code scanners)

In later firmware releases support has been added for certain other HID devices such as touch screens and joysticks. Please refer to the section regarding USB Device Registration (see page 35) and **Appendix H: New Features**, page 57.

Note: Mass storage devices (virtual media) cannot be supported.

May hubs be connected to the Remote Unit?

Yes. A maximum of four external hubs may be connected. Each port supports a maximum of two hub layers.

How many devices may be connected to the Remote Unit?

Currently, a maximum of seven USB devices are supported. Note that a hub is a USB device, and so a keyboard with an integral hub counts as two devices.

Each USB device may also have multiple HID interfaces. A keyboard with multimedia keys usually has two USB interfaces. The extender currently supports a maximum of five HID device interfaces.

How many keyboards and mice may be attached?

You may attach multiple devices. This is useful for connecting additional peripherals, such as bar code scanners, which act as a standard keyboard or mouse.

I am having problems using the extender on a Sun system.

Please ensure the latest version of Solaris (with all patches) is installed.

5.3 Audio

The audio is very quiet.

The audio I/O is line-level and requires amplified speakers and connection to devices providing line-level I/O.

The audio is loud but distorted.

Check that the audio input is not greater than line level (4V peak-to-peak). The KVM extender accepts line-level audio input only.

The microphone output is barely audible.

See **Appendix E: Audio/Serial Ports**, page 51.

5.4 Serial

My serial device does not function.

The extender supports serial devices at data rates not exceeding 19.2K Baud (although 38.4K operation might be possible with certain equipment).

Check the type of flow control used by the device and CPU. The extender supports RTS, CTS, DTR, and DSR. Some systems may require a wiring adapter to transfer RI and DCD.

Attach the device directly to the serial port on the PC and test whether the problem is a PC or extender problem.

Some serial devices cannot be hot-plugged. Try connecting the device to a powered Remote Unit prior to booting the system.

5.5 General Questions

Is it possible to use a cable longer than 1000ft (300m)?

It might be possible to use a cable of up to 1650ft (500m) at lower resolutions. However, we do not recommend this and cannot guarantee that it will work.

Can the extender be daisy chained?

In certain circumstances, it is possible to cascade extenders, though we do not recommend doing so. Careful consideration needs to be given to extender setup, and the electrical environment. If you plan to cascade extenders, please contact Technical Support.

Which interconnection cable is best?

The extender will operate with either shielded (STP/FTP) or unshielded (UTP) CATx cable. However, correctly installed shielded cable is preferred, especially in electrically noisy environments, because it resists interference more strongly, limits ground potential differences, and reduces emissions. To benefit from shielded cable the shield connection *must* be maintained from end to end through any intervening patch cables, panels and RJ45 connectors.

Please note that shielded cable is advised in order to maintain regulatory EMC compliance.

Can the extender system be used between buildings?

No. Ground loops could damage the extender system and attached equipment.

Can multiple Local/Remote Units be used by swapping the interconnection cable?

Local Units provide full keyboard and mouse emulation, so it is possible to swap or switch the local-remote interconnection to create a KVM matrix-switch system. You will need to be careful if you have used USB Device Registration! Please call Technical Support prior to deploying such a system.

Can the extender be connected into our network?

Absolutely not. Regardless of the cable similarities, the data signals and voltages used by the extender are different from those used by Ethernet and other types of networks. Connecting the extender to a LAN hub, switch, repeater, or other network device, or exposing it to the signal levels present on network data lines may damage the extender and other devices.

Appendix A: Example Application

This section illustrates a non-standard application using CATx KVM Extender units:

- Two remote users sharing access to the CPU.

For more specific information about this, or any other complex applications, please discuss suitable extension architecture with your Technical Support.

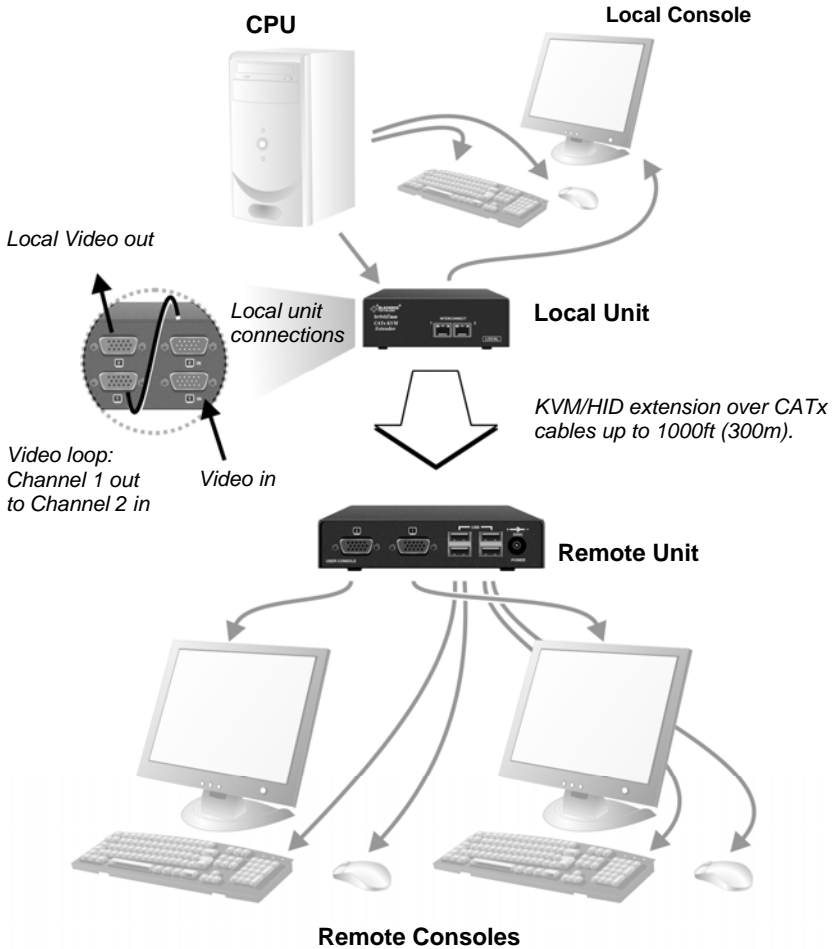


Figure 9

Two users at Remote Unit utilizing a dual-head extender

Appendix B: Rack Mount Options

Up to three extender units, in any combination, can be mounted in a 19" rack using the RMK19U-X3 mounting kit.

The kit contains one rack plate and M3 countersunk mounting screws.

To mount a unit:

1. Remove the feet from the extender unit.
2. Align the holes on the base plate with the vacant screw holes on the base of the extender unit.
3. Fasten the base of the unit to the plate of the mounting kit using the supplied screws.

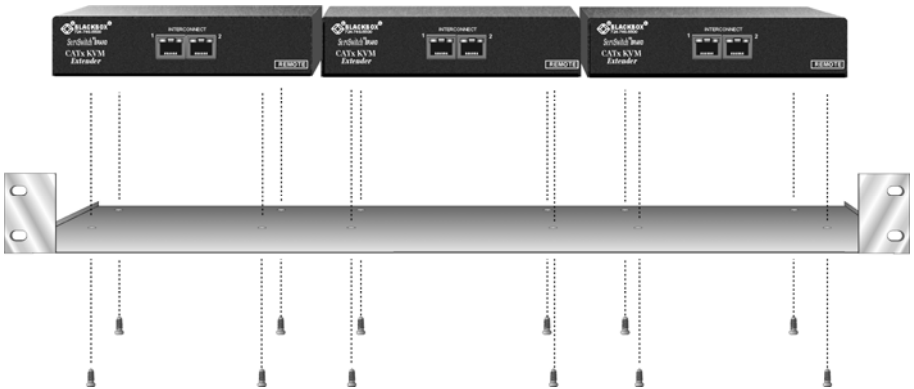


Figure 10 RMK19U-X3 Mounting Kit

Appendix C: Flash Upgrading & External Configuration

The extender's firmware is fully flash upgradeable. Please consult **Appendix H: New Features** Appendix H: New Features, page 57 which describes additional functionality introduced in the latest firmware releases.

The firmware may be upgraded via USB. In addition, the current extender configuration (video settings) can be saved and restored.

Firmware upgrade files should be downloaded online. Please consult Technical support for details on how to obtain them. Full release notes are included with these files.

On entering Upgrade Mode the extender detaches itself from the USB and re-enumerates as a removable disk drive allowing upgrades to be made.

Preparation

The Local and Remote Units must both be connected and powered even if you only wish to upgrade one of them.

Connect a mouse & monitor directly to the CPU as the remote KB & Mouse will not function in Upgrade Mode. Alternatively, connect the Local Unit to a laptop.

Entering Upgrade Mode

1. From the REMOTE KB enter Command Mode
2. Now enter <Left Control> + <Left Shift> + <Right Shift> + <F9>

The yellow LED on both the Local & Remote Units will light to indicate Upgrade Mode has been entered.

Your PC should indicate a flash drive called EXTENDER is attached. Under many operating systems a window showing the contents will pop up. If the drive contents window does not appear, then you will need to manually open the drive folder.

Operating Upgrade Mode

When in Upgrade Mode you must use a KB/mouse attached directly to the PC.

You will see four *virtual* files listed:

BOOT	Delete this file to return to normal extender operation.
LOC_xx	This shows the firmware version in the Local Unit. If the version is reported as 'LOC_BAD' the upgrade was not successful – try again
REM_xx	This shows the firmware version in the Remote Unit. If the version is reported as 'REM_BAD' the upgrade was not successful – try again.
CONFIG	This file contains the current extender configuration. You may save this file and use it setup another extender by dragging it onto the file window and overwriting it.

Upgrading a Local Unit

Drag the local firmware file provided onto the window. After a few seconds the window display should refresh and the new firmware version displayed by file 'LOC_xx'

If the window does not refresh (will not on some OS), and the dragged upgrade file is still shown, then you may need to re-power the Local Unit (by disconnecting the USB cable) and view the drive folder again.

If the 'LOC_xx' file displays as 'LOC_BAD' the upgrade was not successful. Try again or call technical support.

If the upgrade was successful and you only want to upgrade the Local Unit, delete the file BOOT. The extender drive will disconnect itself and normal extender operation will resume.

Note: If the upgrade was not successful, you will not be able return to normal operation and the extender will remain in Upgrade Mode.

Upgrading a Remote Unit

You need to drag each of the EIGHT the firmware files provided onto the window. Simply highlight them all and drag in one operation. After approx 50 seconds the window display should refresh and the new firmware version displayed by file 'REM_xx'

If the window does not refresh (will not on some OS), and the dragged upgrade files are still shown, then you may need to re-power the Local Unit (by disconnecting the USB cable) and view the drive folder again.

If the 'REM_xx' file displays as 'REM_BAD' the upgrade was not successful. Try again or call technical support.

If you have finished upgrading both units delete the file BOOT. The extender drive will disconnect itself and normal extender operation will resume.

Note: If the upgrade was not successful you will not be able return to normal operation and the extender will remain in Upgrade Mode.

Important Notes

1. This upgrade feature is not guaranteed to work correctly with all operating systems. It was designed for Windows but has successfully been tested on Mac OS X and some Linux distributions.
2. The feature functions best if write caching is switched off for flash drives. This done by default on XP SP2, Vista and OS X. If write caching is not disabled then file writes or deletes may take up to 45 seconds to complete. For example, under Windows 2000 or Linux if you delete the BOOT file to return to normal operation, it may take 30 seconds before the file is actually deleted and the EXTENDER drive reported as removed.
3. Do not attempt to drag any other kinds of file onto the Extender drive. It is a virtual storage device.

Consult Technical Support if you have any issues regarding upgrading.

Upgrading Tips

If you have a number of installed units to upgrade you may not need to move them in order to upgrade.

Example: To upgrade a number of Local Units installed in a rack you may find it much faster to bring a Remote Unit & USB KB into the same room as the Local Units. To upgrade each Local Unit in turn simply connect a patch cable from the Remote to the Local Unit and then enter the Upgrade Mode entry sequence on the remote KB. Now, with the aid of a flash drive (or upgrade file located on a shared drive), you may simply upgrade the Local Unit (by dragging the file on to the extender drive) and then delete the BOOT file before moving on to the next unit.

Example: To upgrade a number of Remote Units you may find it much faster to use a patch cable to connect (in turn) each Remote Unit to a nearby notebook which has a Local Unit connected.



When upgrading a number of units, ensure the BOOT file is deleted after *each* upgrade is complete. If you forget to do this and are left with a Local or Remote Unit that is stuck in Upgrade Mode (orange LED lit), simply re-power the unit to which it is connected. Both units will now re-enter Upgrade Mode to enable you to delete the BOOT file and return to normal operation.



After upgrading your extender it is good practice to put a label on the underside of the unit(s) to indicate which firmware version has been installed.

Appendix D: Advanced Cabling Issues (Skew)

The suggestions made in this Appendix should only be investigated if you cannot obtain satisfactory image quality after configuring the Remote Unit (as described in Section 4). The techniques described here are usually only necessary when you are operating at the highest screen resolution (1600x1200) with long Interconnect cables.

Dealing with Severe Skew

The CATx KVM extender provides a maximum skew compensation of 42nS. This is more than adequate for most cables. However, it may not be enough if a particularly long cable is used that exhibits severe delay skew. In this case, some of the procedures described below should be considered. In extreme cases you should consider an alternative CATx cable as recommended by Technical Support.

Green Delay

Introducing delays in the video signals inevitably may cause some distortion. For example, it may result in pixels being sampled twice on TFT screens.

The human eye is extremely sensitive to green distortion. To obtain optimal video performance it is best to ensure that no green delay is required. You can visually check the relative pair delays by viewing the test card (without any delays applied). The two color bars on the left require delaying, but the color bar on the right requires zero delay (slowest) and is the reference. Ideally, green should be the reference signal.



If your system requires a large delay on the green signal, try using a crossover patch cable at each end of the link (instead of straight patch cables to connect to wall outlets). In many cases, the crossover should transfer the delay requirement to the blue signal rather than green. The human eye is much less sensitive to blue distortion and so video quality can be improved. Check the result using the test card and adjust the delays accordingly. The main cable should be wired according to EIA-568B as shown below.

Cable Pinning/Pairing

The following table illustrates which RJ45 connector pins the extenders use for various signals. It also details the standard EIA-568B wiring scheme that is recommended for most installations.

Looking into the RJ45 socket on a *Remote Unit*, Pin 1 is on the right and Pin 8 on the left.

<i>Pin</i>	<i>Color (EIA-568B)</i>	<i>Signal</i>
1	White/Orange	Blue Video
2	Orange/White	
3	White/Green	Green Video
6	Green/White	
4	Blue/White	Red Video
5	White/Blue	
7	White/Brown	Data
8	Brown/White	

Using a crossover cable (at each end) will put the green video on the orange colored pair and the blue video on the green colored pair.



EIA-568A wiring can also be used. Contact Technical Support for details.

Optimizing Pairs (General Solution)

Measure pair lengths with a LAN cabling tester (TDR) or view pairs by stripping back a small piece of cable and viewing how tightly pairs are twisted. The most tightly twisted pair is the slowest (longest) and the loosest pair the fastest (shortest). You can also check the relative delays using the test card as described on page 28.

The table below shows the general solution for optimizing CATx cabling for video in order of pair length.

<i>Pins</i>	<i>Pair</i>	<i>Signal</i>
7 & 8	Shortest Pair	Data
1 & 2	3 rd Longest Pair	Blue Video
4 & 5	2 nd Longest Pair	Red Video
3 & 6	Longest Pair	Green Video

Some cables have a '3+1' construction where three pairs closely match. The fourth pair should be used for data and the other pairs sorted as in the above table.

Other cables have a '2+2' construction where there are two sets of dissimilar pairs. Put red and green on one set (tightest) and blue & data on the other.

A suitable pair-swapping scheme is easily made using custom wired patch cables at each end.

Appendix E: Audio/Serial Ports

Operation & Multi-Port Configuration

This appendix describes audio & serial interface operation for those models that have this feature:

- ACU6022A
- ACU6222A

These extender products contain daughter boards that allow bi-directional stereo audio and a full-duplex serial data link to be sent across the CATx interconnection cable in addition to data and video.

Serial Interface - Set Up and Operation

No setting up or user adjustments are required. Please note that on dual access Local Units, the serial link is always active.

The Remote Unit's serial port is wired as DTE - the same as that on a PC. To connect a serial printer or other DTE (rather than DCE device) to the Remote Unit, you will need a Null-Modem crossover cable between the Remote Unit and the printer. Select Xon/Xoff software flow control on the printer and PC.

A serial touch screen may be plugged directly into the Remote Unit.

Serial Interface – Handling Multiple Serial Devices

The extender's serial interface transmits/receives six signals (3 signals in each direction).

Normally, four of these signals are used for hardware handshaking (in addition to TX & RX). However, because each handshaking line can support signals up to 19,200 Baud it is possible to configure the serial interface to handle up to three simple 2-wire (Tx/Rx only) serial links.

To do this, you will need to construct a custom breakout cable. Please contact Technical Support for further information.

Audio Interface - Set Up and Operation

The audio interface is line-level and is designed to take the output from a sound card (or other line-level) source and be connected to a set of powered speakers at the other end of the link.

Stereo audio may be transmitted either way across the link (simultaneously).

No setup is required unless a microphone is connected to the Remote Unit.

Connect the extender as follows:

- Take the line-level output from your sound card (green connector) and connect to 'Line In' on the Local Unit.
- Connect 'Line Out' on the Remote Unit to a set of powered speakers.

Audio Interface – Using a Microphone

A microphone may be plugged into the 'Line In' connector on the Remote Unit.

There are two ways of setting up a microphone:

- The Local Unit's 'Line Out' connection should normally be wired to the microphone input (Pink) on your sound card. The sound card should then be set up to provide additional amplification (+17dB). This is the preferred connection method.
- Alternatively, the Remote Unit itself can provide microphone amplification. To set this, open up the Remote Unit and locate the jumper labeled 'MIC' on the daughter board. Connect this jumper across the pins. The Local Unit's 'Line Out' connection should then be wired to 'Line In' (Blue) on your sound card.

If your microphone is already amplified, follow the second method, but **DO NOT** install the amplification jumper in the Remote Unit.

Appendix F: Calling Black Box

If you determine that your CATx KVM Extender is malfunctioning, *do not attempt to alter or repair it*. It contains no user-serviceable parts. Contact Black Box Technical Support at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- The firmware-revision level printed on the bottom of the Extender (very important, especially for keyboard and mouse problems); The KVM extender's firmware revision level:
Version Number Format: xxSyy/zz
xx is the hardware revision number
yy is the firmware revision number
zz is the auxiliary revision number.
- The nature and duration of the problem.
- When the problem occurs.
- The components involved in the problem—that is, what type of computers, what type of keyboard, brand of mouse, make and model of monitor, type and make of CATx cable, etc.
- Any particular application that, when used, appears to create the problem or make it worse.
- The results of any testing you've already done.

To solve some problems, it might be necessary to upgrade the Extender's firmware. If this turns out to be the case for your difficulty, our Technical Support technicians will arrange for you to receive the new firmware and will tell you how to install it.

Shipping and Packaging

If you need to transport or ship your CATx KVM Extender:

- Package it carefully. We recommend that you use the original container.
- If you are shipping it for repair, please include the Remote Unit's external power supply. If you are returning it, please include everything you received with it. Before you ship the Extender back to Black Box for repair or return, contact us to get a Return Authorization (RA) number.

Appendix G: Specifications

Video

<i>Maximum Resolution</i>	1600x1200@60Hz over 650ft (200m) 1280x1024@75Hz over 1000ft (300m) Operation at higher resolutions/refresh rates is possible at shorter distances
<i>Video Compatibility</i>	Analog VGA to UXGA, RGB
<i>VESA DDC</i>	Emulated DDC for each video channel Local Unit reports as universal monitor capable of all standard resolutions and refresh rates. DDC information may be disabled, or read directly from remote monitors.
<i>Video I/O</i>	0.7V P-P
<i>Skew Compensation</i>	15-stage. 42nS Max. 2.8nS per step Compensation available on each color
<i>Video Compensation</i>	Separate LF & HF Equalizers
<i>Video Coupling</i>	DC
<i>Sync I/O</i>	Separate/Composite TTL Level Sync on green Sync Polarity is preserved
<i>Video Input Connectors</i>	HD15 (Male)
<i>Video Output Connectors</i>	HD15 (Female)

USB

<i>Emulation Compatibility</i>	Standard HID Keyboards & Mice, Hubs Certain additional HID devices may be supported with newer revision firmware. See Appendix H: New Features .
<i>Local Unit USB Connector</i>	USB B Socket
<i>Remote Unit USB Connectors</i>	4 x USB A Socket

Serial Interface

<i>Max Baud Rate Supported</i>	19.2K Baud
<i>Serial Data Format</i>	Transparent
<i>Signals Transferred</i>	TX, RX, RTS, CTS, DTR, DSR
<i>Local Unit Connector</i>	DB9 Female (DCE)
<i>Remote Unit Connector</i>	DB9 Male (DTE)

Audio Interface

<i>Description</i>	Bi-directional stereo audio link
<i>Transmission method</i>	Digitized virtually CD quality audio (16-bit, 38.4kHz)
<i>Signal levels</i>	Line level (4 Volts Pk-Pk maximum)
<i>Input Impedance</i>	47k Ω
<i>Local Unit Connectors</i>	2 x 3.5mm stereo jack socket (Line In & Line Out)
<i>Remote Unit Connectors</i>	2 x 3.5mm stereo jack socket (Line/Mic In & Line Out)
<i>Microphone Support</i>	Microphone may be connected to Remote Unit Pull-up resistor provides bias for condenser microphone Option to set microphone amplification to +17dB

Power Requirements

<i>Local Unit</i>	5V at up to 275mA supplied through USB interface. Connector for optional 5V PSU 2.1mm DC Jack, center positive Overvoltage Protection: 6.0V
<i>Remote Unit</i>	5V DC. Remote Unit itself requires up to 1.2A. Remainder is available to USB devices (1.1A fused). 2.1mm DC jack, center positive Overvoltage Protection: 6.0V
<i>Remote Unit Power Supply</i>	5V DC, 3A (18W) Regulated (certified to all relevant safety standards) Universal IEC Input 2.1mm DC jack, center positive

SERVSWITCH™ BRAND CATX KVM EXTENDER FAMILY

Size and Shipping Weight

<i>ACU6001A</i>	Local Unit: 4.9"x4.5"x1.2" (124x113x30mm) Remote Unit: 5.7"x5.9"x1.2" (144x151x30mm) Shipping Weight: 4.4lb (2.0kg)
<i>ACU6201A</i>	Local Unit: 4.9"x4.5"x1.7" (124x113x44mm) (1U) Remote Unit: 5.7"x5.9"x1.2" (144x151x30mm) Shipping Weight: 4.9lb (2.2kg)
<i>ACU6022A</i>	Local Unit: 4.9"x4.5"x1.7" (124x113x44mm) (1U) Remote Unit: 5.7"x5.9"x1.7" (144x151x44mm) (1U) Shipping Weight: 4.9lb (2.2kg)
<i>ACU6222A</i>	Local Unit: 5.7"x4.5"x1.7" (145 x113x44mm) (1U) Remote Unit: 5.7"x5.9"x1.7" (144x151x44mm) (1U) Shipping Weight: 5.3lb (2.4kg)

Environmental

<i>Operating Temperature</i>	32 to 104°F (0 to 40 °C)
<i>Storage Temperature</i>	-22 to 149°F (-30 to 65 °C)
<i>Relative Humidity</i>	5-90% non-condensing
<i>Chassis Construction</i>	Fully shielded. Black painted steel

Appendix H: New Features

This section describes new features added in the later firmware releases.

The label on the base of each Local or Remote Unit shows which firmware version has been factory installed (see **Appendix F: Calling Black Box**, page 53).

<i>Firmware Version</i>	<i>Feature Added</i>
<i>V2.0 (S20 - Jan 2009)</i>	Enhanced Keyboard & Mouse Support Generic HID Device Support Private Mode
<i>V2.3 (S23 - Nov 2009)</i>	Enhanced ELO Touch Screen Support (including Calibration)



Due to the large number of changes, v2.x firmware is not totally compatible with earlier v1.x firmware. In particular, the mouse will not function if a v2.x Remote Unit is connected to a v1.x Local Unit. To avoid such issues please ensure that both local and remote have compatible firmware versions installed.



Firmware with a higher revision number (later date) will normally include all the new features added to earlier versions.

Enhanced Keyboard & Mouse Support (v2.0)

In previous releases only basic USB keyboards and mice were supported. In v2.0 the HID parser has been extended to handle newer laser mice and combination wireless KB/Mouse devices that often use 'non-standard' report formats.

Support has also been added for mouse pan/tilt (horizontal scrolling) for those operating systems that support it within their native HID drivers (e.g. Vista).

Generic HID Device Support (v2.0)

Previously only KB and mouse type devices (including bar code scanners) were supported. Additional keys on multi-media keyboards could be handled through a Remote Unit command: <Left Control> + <F4>.

In this firmware release a wider range of generic HID devices is supported subject to certain restrictions.

Firmware v2.0 now supports almost any HID device which only sends data to the CPU, and does not require a vendor driver (i.e. it uses the native HID drivers of the operating system).

Supported generic devices include additional keys on multi-media keyboards, basic joysticks, and some touch screens (basic mode) and card readers.

Up to four generic devices (in addition to the KB & mouse) may be connected.

1. Connect all the generic HID devices (e.g. a joystick, or KB with multimedia keys) you wish to register to the Remote Unit.
2. Enter Command Mode: <Left Control> + <Left Shift> + <F10>.
3. Register the devices by requesting USB Descriptor transfer: <Left Control> + <F4> (See page 35).

The Remote Unit will now read the USB descriptors from the generic devices and copy them to the Local Unit. After a few seconds the Local Unit will then re-enumerate as a composite device with several HID interfaces. The registration process is only required once because the descriptor data is permanently stored within the Local Unit, and the Remote Unit has logged the VID/PID of all registered devices.

Registered devices may be disconnected and re-connected to the Remote Unit without the need to register again.

Note: Each time a registration is requested (<Left Control> + <F4>), all previous registration data is overwritten; so you must ensure that all devices to be registered are connected. If you need to restore the extender to its default state with only basic KB/Mouse emulation, simply request a registration without connecting any generic devices (or, issue the system reset command: <Left Control> + <F9>).

You do not normally need to register keyboard or mouse type devices. If however, you are having problems getting a KB/Mouse to work, you could try registering it in case it has descriptors which are 'non-standard'.



USB devices connected to the Remote Unit cannot be associated with any particular vendor driver.

Private Mode (v2.0)

In previous releases the only Private Mode option was to blank the monitors connected to the Local Unit. Firmware v2.0 enhances Private Mode operation as follows:

Remote Private Mode

- In this mode monitors connected to the Local Unit are blanked.
- It is not possible to disable the local KB/Mouse because they are connected directly to the CPU.
- To enable Remote Private Mode enter Command Mode (<Left Control> + <Left Shift> + <F10>), and then press <Scroll Lock>.
- All monitors are now blanked, and the yellow LED on the Remote Unit will now flash at double speed (as an indication).
- To exit Remote Private Mode, issue the same command sequence again.
- The current Remote Private Mode state is stored in EEPROM, and is restored on power-up.

Local Private Mode

- In this mode all remote HID devices are disabled, and (optionally) all monitors connected to the Remote Unit are blanked.
- **The Local Private Mode feature is inhibited by default and has to be explicitly enabled (as described below).**
- **If Local Private Mode is allowed, the remote Console enable/disable state is toggled by pressing Caps Lock or Scroll Lock, eight times within two seconds on any keyboard connected directly to the CPU.**
- The Remote Unit is now disabled, all three KB LEDs on the remote KB are lit, and the yellow LED on the Local Unit will now flash at double speed (as an indication).
- To exit Local Private Mode, issue the same command sequence again.
- The current Local Private Mode state is stored in EEPROM, and is restored on power-up.

Remote Monitor Blanking in Local Private Mode

A further remote command has been added to control whether the remote monitors are blanked in Local Private Mode. The default setting is to blank them.

To toggle the remote monitor blank state:

1. Enter Command Mode
2. Press <Left Control> + <Scroll Lock> to toggle the state
3. The setting is saved in EEPROM, and the unit will quit Command Mode.

Local Private Mode Inhibit

This feature is inhibited by default. To enable/disable this feature:

1. Enter Command Mode
2. **Enable:** Press <Left Control> + <F7> , or, **Disable:** Press <F7>
3. The setting is saved in EEPROM, and the unit will quit Command Mode.

Note: Local Private Mode is inhibited by default because it operates by sensing a sequence of KB Indicator changes. To prevent any possible conflict with 3rd party equipment (e.g. KVM switches) that may toggle the LEDs too often, this feature is disabled unless the user specifically requires it.

Enhanced Elo Touch Screen Support/Calibration (v2.3)

In Firmware v2.0 Generic HID device support was added. This allowed touch screens (which could operate using OS native HID support) to be used through the extender in a basic mode. However, the extender cannot utilise any vendor driver supplied with a touch screen for calibration/enhanced options etc. Operation in basic mode may not be suitable for all applications.

We have found that many ELO Touch screens require calibration to scale reports to the full screen area, and also correct X or Y-axis reversal. For example, you might touch the upper right-hand corner and the cursor will move to the lower right-hand corner, or the cursor may not move exactly to the location you touch.

Calibration and axis reversal is normally sorted out in the calibration sequence via the vendor driver. When operating through the extender the vendor calibration routine is not available and so the following command has been added to effect basic calibration.

You first need to register the ELO Touch Screen with the extender system:

1. Connect the ELO monitor and a keyboard to the Remote Unit
2. Enter Command Mode: <Left Control> + <Left Shift> + <F10>
3. Enter the Device Registration command <Left Control> + <F4>
4. The extender will now re-enumerate and allow basic touch screen operation

Note: See Generic HID Device Support (above) for further information regarding generic HID device support.

The cursor should now move as you touch the Elo monitor. However, the direction of movement may be reversed, and the cursor might not travel over the entire screen area.

Calibration

You now need to calibrate the touch screen:

1. Enter Command Mode: <Left Control> + <Left Shift> + <F10>
2. Enter the ELO Calibration command: <Left Control> + <F5>
3. The KB LEDs will flash twice and then stay lit.
4. Touch the ELO screen once right in the *UPPER LEFT-HAND CORNER* ^{See Note}
(do this within 10 seconds).
5. The KB LEDs will clear.
6. After a second the KB LEDs will flash twice and stay lit.
7. Touch the ELO screen once right in the *LOWER RIGHT-HAND CORNER* ^{See Note}
(do this within 10 seconds).
8. The KB LEDs will clear and then flash twice after a second if the calibration was successful.
9. The extender will now quit Command Mode.
10. The touch screen is now calibrated and any reversed axes are automatically adjusted.

- You only need to perform the above operation once. The settings are saved in EEPROM.
- If you want to connect further touch screens then all touch screens **MUST** be the same model.
- You should re-calibrate whenever you register additional (or replacement) generic HID devices.
- If there were any problems during calibration the extender will quit Command Mode and resume normal operation after the time-out period.



Ultimate calibration accuracy depends on how tightly into the screen corners you touch.

NOTES

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Customer Support Information:

Order toll-free in the U.S.: Call **877-877-BBOX** (outside U.S. call **724-746-5500**)
For FREE Technical Support 24 hours a day, 7 days a week, call **724-746-5500** or fax **724-746-0746**
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